Klasifikace a dopady inovací uvedených českými malými a středními podniky

Classification and Impact of Innovations Launched by Czech Small and Medium-sized Enterprises

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Abstract:

Purpose of the article: The article is focused on innovation activities that are considered a key element for future competitiveness of small and medium-sized enterprises. As a result, various public policies supporting innovative enterprises are being presented both on European and national level. However, few of them have already contributed to higher innovative performance of small and medium-sized enterprises. One of the reasons is the unclear definition of innovations and lacking comparison of commercial performance of various types of innovations. The article intends to fill the research gap and provide additional information about innovation activities of Czech small and medium-sized enterprises, which might help not only policy-makers and scholars but also business owners and managers. At the very beginning, the article identifies key issues in current methodologies of innovation classification and provides its own solution. Based on the proposed classification and supported by a survey, it gives an overview of how Czech small and medium-sized enterprises (SMEs) implement such innovations and how successful these innovations typically are. As a result, the article provides important insights for innovation managers in their decision-making processes. It also provides important inputs for academic research in the field of innovation management.

Scientific aim: The article intends to contribute to the current scientific discussion of innovation performance of Czech SMEs. It looks at innovations from a multi-dimensional perspective and provides own methodology of their classification. Based on the data gathered within a recent survey, it discovers what type of innovations Czech SMEs typically deal with and how successful such innovations are after their launch.

Methodology/methods: In order to fulfil the scientific aim, various methods were used. Based on analysis of current literature, a complex overview of current issues in innovation management was obtained. Using synthesis, own methodology of classification of innovations was presented, building on and developing other current methodology systems. Based on the own classification, empirical testing was performed within an electronic survey.

Findings: The article discovers high reliance of Czech SMEs on know-how demanding innovations, especially those requiring new technologies and new knowledge. They are not only the innovations that are the most likely to be launched once an enterprise wants to achieve a long-term competitive advantage or disrupt a market. They also play an important role for enterprises trying to gain a short-term competitive advantage or to maintain their competitiveness. The results, however, show that in many cases the enterprises would be better off relying on different type of innovations not only by raising the success rate but also by saving significant R&D costs.

Conclusions: The results of the survey provide important inputs for future research that should focus on raising awareness of less technologically demanding innovations in Czech small and medium-sized enterprises. As results of foreign surveys show, such innovations not only lead to a competitive advantage that is sustainable in a long-term but are also less demanding in terms of finance.

Keywords: Innovation, small and medium-sized enterprises, innovation management, classification of innovations, innovation performance

JEL Classification: O32, O33

Introduction

Innovations have been identified as a key factor for economic growth not only on macroeconomical (Schumpeter, 1950) but also on microeconomical level where they play a crucial role in creation and maintenance of competitive advantage (Penrose, 1959; Ansoff, 1965; Jones, 2003; Porter, 2003; Tidd *et al.*, 2007). Despite their complexity, innovations have often not been classified in the same way in the academic literature. Therefore, the research might lead to misleading results as it often builds on previous research results comparing different types of innovation. Various problems might arise in the case of practicioners trying to measure performance of their innovation activities.using various advanced methods (Bartoš and Žižlavský, 2010)

The generally accepted classification of innovations is represented by two groups of approaches focusing either on the level of technological advancement or on the market impact of an innovation. The first group is represented by various innovation scales known also in the Czech academic literature (Valenta, 1969; Švejda *et al.*, 2007; Heřman *et al.*, 2008), various dynamic models (Abbernathy and Utterback, 1978; Tidd *et al.*, 2007) and even statistical methodologies (OECD, 1997). The second group of classification approaches is typically represented by more recent work (Christensen, 1997; Christensen and Raynor, 2003, Kim and Mauborgne, 2005; Anthony *et al.* 2008). In the latter case, the authors focus more on the commercial impact of an innovation rather than on the level of technological progress. Some of the new contributions have already

been implemented into new statistical methodologies (OECD, 2005) that are being widely implented.

However, few methodologies combining both approaches have been presented despite the fact, that such classification would be needed in most cases. One can easily imagine an innovation that might be disruptive in terms of its commercial impact and based on obsolete, as well as the newest technology. On the other hand, a new technology could in some cases just help maintain competitive advantage, in other cases it might open a whole range of new markets. An article summarizing some of the new methodologies was presented by Chwaszcz (2010). However, in order to provide better understanding of classification of innovations, the article proposes a new classification method and provides an overview of what types of innovations based on the proposed classification are being launched by Czech SMEs.

1. Problems of classifications of innovations based on the level of technological advancements

As technological progress had often been considered to be an inherent part of innovations, many scholars suggested various methods classifying innovations on the basis of technological advancements. In Czech literature, such approach is represented by Valenta's methodology (Valenta, 1969) that has been employed in work of most authors in the field of innovation management (Dvořák *et al.*, 2006; Švejda *et al.*, 2007, Heřman *et al.*, 2008). In Valenta's work, 10 groups of innovations called Orders

Table 1. Valenta's classification of innovations.

Order	Definition	What is retained	What is changed
0	Regeneration	Object	Regeneration of properties
Rationalization (Redeployment)			
1	Quantum change	All properties	Factor's frequency
2	Intensity	Qualities and links	Speed of operations
3	Reorganization	Quality properties	Dealing of activities
4	Quality adaptation	Quality for users	Links to another factors
Qualitative continual innovation			
5	Variant	Procedure of construction	Partial quality
6	Generation	Conception of construction	Procedure of construction
Qualitative non-continual innovation			
7	Kind	Core of technology	Conception of construction
8	Tribe	Affiliation to the trunk	Core of the technology
Technological revolution – microtechnology			
9	Trunk	Nothing	Access to the nature

Source: Švejda et al., 2007.

can be recognized. Valenta`s classification proved its relevance in many industrial sectors. However, as traditional industry began to play less significant role in economies at the end of 20th century, such classification began to ignore many of the most important aspects of innovations launched for example in the service or medium-tech sectors. Even in the high-tech sectors, now heavily represented by ICT-related industries, many successful innovations are built on an obsolete technology but resulted in a commercial success. The limitations of Valenta's methodology can generally be divided into 3 groups:

1. Focus on product innovations, although many innovations have been recently launched in service sector. Even in the industrial sectors, new products are often bundled with new services so that they could create higher added value. Looking solely at the level of technological progress, important non-technological improvements would be ignored and would not be considered real innovations.

2. Lack of understanding of new types of innovations. Recently, new types of innovations have been recognized by academia and implemented in the real businesses. Business model innovations, marketing innovations and process innovations represent the most important of them. For example, for many enterprises, business model innovations already play more important role than technological innovations (EIU, 2005; IBM, 2008; BCG, 2009).

3. Belief that new technologies are superior then the current or older ones. In reality, there have been many cases when a product based on older technology outperformed other products based on a newer one in terms of commercial success (Christensen, 1997; Anthony *et al.*, 2008).

2. Problems of classifications of innovations based on the level of technological advancements

Many authors identified some of the above mentioned problems and focused more on the commercial impact of an innovation while not taking into account the level of the technological progress. One of the pioneering works was presented by Clayton Christensen (1997). Christensen came to its classification by studying the hard-disk drive industry that had undergone in few decades a very rapid development that would usually take more than a century. Christensen identified the most important innovations in the sector and described their common characteristics. He found out that not always

the most successful innovations were based on a new technology. What often mattered was the application of the technology or other non-technological factors. Therefore, he used the commercial impact of an innovation as a decisive factor and came to a split into two groups of innovations – sustaining and disruptive innovations.

The sustaining innovations are represented by incremental improvements of those characteristics of a product (service), that are considered to be the most important in the industry. Therefore, it is very likely that a competitor is working on a similiar innovation and in the near future is going to reach the same level and eliminate the competitive advantage created by this innovation.

On the other hand, disruptive innovations bring to customers a whole new value focusing on the characteristics of products/services that have not been considered important or have not been taken into account at all.

Similar approach was used by Kim and Mauborgne (2005) in their book presenting value innovations leading to creation of blue oceans. In Czech literature, many authors have recently identified Christen`s work (Dvořák *et al.*, 2006; Jirásek, 2006), however, such approach of classification of innovations has not yet been widely implemented.

Despite its novelty in terms of focus on the commercial effect of an innovation, Christensen's classification does not help identify the correct type unless an inovation is launched into the market. In this way, important characteristics of innovations could be overlooked.

3. Combination of classifications

As presented above, many of the methodologies used in innovation management literature suffer from certain limitations. Therefore, own approach combining both technological, as well as commercial dimension is presented.

At the horizontal level in the proposed model, the technological advancement of an innovation is represented by four different levels. An innovation that is based on current technologies and current knowledge would be one of the extreme cases, innovation requiring new technologies and new knowledge would be the other one. In between, innovations based on new technologies and current knowledge and innovation based on current technologies and new knowledge would be placed.

The vertical dimension represents commercial impact an innovation is supposed to have. It may eit-

Table 2. Classification of innovations combining technological and commercial dimension.

	Current technologies and current knowledge	New technologies and current knowledge	Current technologies and new knowledge	New technologies and new knowledge
Launch of a disruptive product or service				
Long-term competitive advantage				
Short-term competitive advantage				
Competitiveness maintenance				

Source: Own research.

her help maintain competitiveness, bring short-term competitive advantage, help gain long-term competitive advantage or disrupt the market by a new product or service. Each innovation would usually intend to fulfill one of the above mentioned goals.

Due to the combination of both dimensions, there are 16 different types of innovations.

4. Survey

As there had not yet been any overview about innovations launched by Czech small and medium-sized enterprises, own survey based on proposed classification (combination of level of technological advancement and commercial impact) was performed in the September – November 2011 period. An electronic questionnaire was created using the online service vyplnto.cz and the hyperlink was sent to 2004 e-mail contacts of chosen enterprises.

4.1 Dataset
The survey was sent to a group of enterprises that are considered to be innovative and a group of companies without a publicly recognized track of innovative behavior. The first group consists of:

Enterprises located in business incubators and science and technology parks (STPs) – Business incubators and science and technology parks are institutions providing incubation and acceleration programs for start-ups typically operating in one of the high-tech industries. In order to be accepted to one of these institutions, an enterprise undergoes a screening phase and its innovation, as well as business, potential is tested. Therefore, the enterprises located in business incubators or STPs should have an above-average innovation potential.

Innovative projects participating in start-up contests – In many cases, entrepreneurs might have an innovative idea that would still be in the stage of a project rather than a seriously established enterprise. Such projects often participate in various competitions where the level of innovativeness is evaluated by an independent panel of experts. In this survey, participants of the contest called Startup Show that was organized within the Webexpo ICT conference were contacted.

Innovative small and medium-sized enterprises with longer history – One of the goals of the survey was to gather feedback of the group of innovative enterprises existing on the market for a longer period of time. Therefore, enterprises that obtained public funding in one of the programs supporting innovative activities were contacted. These enterprises not only have longer business history as the programs require business operations of at least 2 years, they should also have proved their innovativeness. Typically, most of the criteria the selection is based on, deal with innovative performance. In this group, enterprises that obtained funding from the Potential, ICT and Strategic Services, Innovation, TIP, ALFA and Innovation Vouchers programs were contacted.

Young enterprises with excellent growth – The last part of the innovative group were the enterprises growing at much faster pace than their average counterparts. In this case, the Czech enterprises mentioned in the Deloitte Fast 50 Central Europe survey were contacted.

Altogether in the group of innovative enterprises 1043 questionnaires were sent to those having publicly discoverable contact details. All the enterprises had their domicile in the Czech Republic are therefore considered to be Czech for our research.

The second ("non-innovative") group consists of the enterprises randomly chosen from the HBI database that gathers all the business legal entities in the Czech Republic. The questionnaire was sent to enterprises operating in following sectors: chemical production, transport, logistics, waste management, production of electronic devices, sport and leisure, furniture, polygraphic services, food production, real estate, construction, textile production, tourism, utilities and agriculture. In this group, 961 questionnaires were sent

Important part of the survey was the identification of the size of the enterprise. In order to test only

SMEs, the answers of enterprises having more than 250 employees were not included in the dataset. Therefore, only 280 out of 304 received answers were researched.

4.2 Results

At the beginning of the survey, the enterprises were asked to choose one of the goals of innovation and the type of innovation they are launching in order to fulfil the goal. Table 3 shows percentage of answers in each of the 16 groups of possible combinations. No matter the goal of the innovation, there was always a very low percentage of enterprises exploiting current technologies and current knowledge. Comparing the four different goals, this type of innovation is most likely (11.1% of enterprises) to be launched when an enterprises intends to gain a short-term competitive advantage. On the other hand, in the case of enterprises willing to gain a long-term competitive advantage, an innovation based on current technologies and current knowledge was used only in 5.6% of cases.

When an enterprise intended to maintain its competitiveness, it launched in most cases an innovation based on current technologies and new knowledge into the market (37. 9%). The second most frequent type of innovation that should help fulfil this goal was an innovation using new technologies and new knowledge (34.7%).

The enterprises willing to gain a short-term competitive advantage followed a very similar pattern. Again, the most frequent way how to fulfil their goal was an innovation based on current technologies and new knowledge (39.3%) followed by an innovation exploiting new technologies and new knowledge (38.5%).

A different behaviour was observed in the case of enterprises willing to gain a long-term competitive advantage. Innovations based on current technologies and new knowledge were not anymore the most likely type of innovation the enterprise would be working on (15.3%). However, major part of enterprises (72.2%) used innovations based on new technologies and new knowledge in order to comply with the innovation goal. Although the goal in this case is not the most radical, the percentage of enterprises launching innovations based on new technologies and new knowledge is the highest.

In the case of enterprises trying to disrupt the market by a new product or service, innovations based on new technologies and new knowledge are the most likely used tool of fulfilment of the ambitious goal. However, only 60.9% of enterprises used them, which is a lower figure than in the previous case. The second most frequent type of innovations were those based on current technologies and new knowledge (20.3%).

The results of the survey show a very high percentage of enterprises working on innovations using new technologies and new knowledge if they want to gain a long-term competitive advantage or want to disrupt the market. However, such goals might often be achieved by current technologies or current knowledge as shows the literature (Christensen, 1997). Strategies based on exploitation of current know-how have been recently implemented by many enterprises due to increasing prices of R&D. However, similar behaviour has not yet been recognized in larger scale in Czech SMEs.

Table 4 shows the results innovations based on various types of technologies and knowledge typically led to. Surprisingly, the highest rate of unsuc-

Table 3. Technological dimension of innovation depending on business goals (%).

Goal of innovation	Technological requirements – absolute value/(%)			
	Current technologies and current knowledge	New technologies and current knowledge	Current technologies and new knowledge	New technologies and new knowledge
Maintain competitiveness	29/(10.5%)	47/(16.8%)	107/(37.9%)	97/(34.7%)
Bring short-term competitive advantage	31/(11.1%)	31/(11.1%)	109/(38.9%)	109/(38.9%)
Help gain a long-term competitive advantage	16/(5.6%)	19/(6.9%)	43/(15.3%)	202/(72.2%)
Disrupt the market by new product or service	22/(7.8%)	30/(10.9%)	57/(20.3%)	171/(60.9%)

Source: Own survey.

Table 4. Results of the innovations depending on the technologies they are based on (%).

Result of the innovation	Innovation based on – absolute value/(%)			
	Current technologies and current knowledge	New technologies and current knowledge	Current technologies and new knowledge	New technologies and new knowledge
Unsuccessful	25/(9.1%)	16/(5.9%)	13/(4.3%)	6/(2.3%)
Maintain competitiveness	89/(31.8%)	123/(44.1%)	125/(44.9%)	94/(33.8%)
Bring short-term competitive advantage	116/(40.9%)	41/(14.7%)	82/(29.0%)	72/(25.6%)
Help gain a long-term competitive advantage	25/(9.1%)	33/(11.8%)	36/(13.1%)	74/(26.3%)
Disrupt the market by new product or service	25/(9.1%)	66/(23.5%)	24/(8.7%)	34/(12.0%)

Source: Own survey.

cessful results was found in the case of innovations based on current technologies and current knowledge (9.1%). On the other hand, innovations built on new technologies and new knowledge are the least likely to be unsuccessful (2.3%).

Innovations based on current technologies and current knowledge are fitting the best to an enterprise's goal of gaining a short-term competitive advantage (40.9%).

Innovations based on current technologies and current knowledge in most cases lead to competitiveness maintenance (44.9%). On the other hand, innovations based on new technologies and current knowledge are those leading in most cases to disruptive products and services (23.5%). The most advanced innovations from the technological point

of view – innovations based on new technologies and new knowledge have the best performance once an enterprise intends to gain a long-term competitive advantage. If the goal is more demanding and the innovation should disrupt the market, such innovations do not have the best performance, although they usually require the highest investments. In this case, they are outperformed by the already mentioned innovations based on new technologies and current knowledge.

Within the survey, the enterprises were also asked what success rate did have innovations with different objectives. The results are shown in Table 5.

As shown in the table, the lowest success rate had the innovations focused on market disruption by a new product or service. Only 38.7% of these

Table 5. Goal of innovations vs. results of innovations (%).

		Result of innovation – absolute value/(%)				
		Unsuccessful	Helped maintain competitiveness	Brought short-term competitive advantage	Helped gain a long-term competitive advantage	Disrupted the market by new product or service
Goal of innovation	Maintain competitiveness	9/(3.1%)	217/(77.4%)	40/(14.4%)	3/(1.1%)	11/(4.1%)
	Bring short-term competitive advantage	0/(0.0%)	34/(12.1%)	237/(84.8%)	0/(0.0%)	9/(3.1%)
	Help gain a long-term competitive advantage	13/(4.5%)	46/(16.7%)	64/(22.7%)	140/(50.0%)	17/(6.1%)
	Disrupt the market new product or service	18/(6.5%)	50/(17.7%)	32/(11.3%)	72/(25.8%)	108/(38.7%)

Source: Own survey.

innovations succeeded as discovered by answers in the survey. Regarding the innovation trying to bring a long-term competitive advantage, only in half of the cases they could be regarded to be successful. The highest success rate had the enterprises trying to gain a short-term competitive advantage – 84.8% of such innovations were successful and fulfilled their goal. Such result is even higher than in the case of innovations that help enterprises maintain their competitiveness. Other innovations with a very high success rate are those helping maintain competitiveness. These innovations were successful in 77.3% cases. The last type of innovations (Innovations trying to gain a long-term competitive advantage) is successful only in 50% of cases regarding the fulfilment of the original goal.

5. Summary

The results of survey revealed an interesting fact, that a significant part of Czech small and medium--sized enterprises still heavily relies on new technologies and new knowledge while launching new innovations. Regarding the innovation goal, these are typically the main type of innovations an enterprise works on while trying to achieve long-term competitive advantage or a disruptive innovation.

However, the results of these innovations discovered that new technologies and new knowledge do not necessarily lead to ambitious goals such as disruptive innovations. In such cases, the survey showed that enterprises were more likely to achieve this goal while relying on new technologies and current knowledge.

Even while realizing less ambitious goals such as gaining a short-term competitive advantage or maintenance of competitiveness, innovations based on new technologies and new knowledge play an important role.

As Czech SMEs have a vast experience with such innovations, they are able to lower the risk of failure. In the case of innovations using new technologies and new knowledge, the percentage of unsuccessful innovations is the lowest. In the case of other goals, these innovations are most likely helping gain a long-term competitive advantage. However, they do not perform very well in the case of less ambitious goals.

On the other hand, less know-how demanding innovations are often underestimated and play a less important role no matter what goal an enterprise have. The results however show they often have a better performance than expected. A very high percentage of them leads to a short-term competitive advantage or help maintain competitiveness.

Regarding the probability of a failure, they have the highest chance among other types of innovations to be unsuccessful.

The above mentioned results provide important inputs for future research that should focus on raising awareness of less technologically demanding innovations in Czech small and medium-sized enterprises. As results of foreign surveys show, such innovations not only lead to a competitive advantage that is sustainable in a long-term but are also less demanding in terms of finance.

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References

Abbernathy, W. J., Utterback, J. M. (1978). Patterns of Innovation in Industry, *Technology Review*, 80(7), pp. 40–47.

Ansoff, H. I. (1965). *Corporate Strategy*. New York: McGraw-Hill, 241 pp.

Anthony, S. D, Johnson, M.W, Sinfield, J. V., Altman, E. J. (2008). *The Innovator's Guide to Growth: Putting Disruptive Innovation to Work*. Boston: Harvard Business Press, 299 pp.

Bartoš, V., Žižlavský, O. (2010). Inovační scorecard jako prostředek měření inovační výkonnosti u MSP. *Trendy ekonomiky a management*, IV(7), pp. 90–104.

BCG. (2009). *Business Model Innovation: When the Game Gets Tough, Change the Game*, 8p., [online] [cit. 2012-06-01] Dostupné z: http://www.econ.upf.edu/~lemenestrel/IMG/pdf/5_bcg_on_bmi.pdf.

Christensen, C., M. (1997). *The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail*. Boston: Harvard Business School Press, 256 pp.

Christensen, C., M., Raynor, M. E. (2003). *The Innovator's Solution: Creating and Sustaining Successful Growth*. 1st edition. Boston: Harvard Business Press, 288 pp.

Chwaszcz, O. (2010). Inovační linie moderní doby I.*Trendy ekonomiky a managementu*, IV(6), pp. 63–79.

Dvořák, J. *et al.* (2006). *Management inovací*. Praha: Vysoká škola manažerské informatiky a ekonomiky, 246 pp.

EIU. (2005). *Business 2010: Embracing the challenge of Change*, 33p., [online] [cit. 2012-06-08] Dostupné z: http://graphics.eiu.com/files/ad_pdfs/Business%202010_Global_FINAL.pdf.

Heřman, J. *et al.* (2008). *Průmyslové inovace*. Praha: Nakladatelství Oeconomica, 260 pp.

IBM. *The Enterprise of the Future: Global CEO Study*. New York: IBM Corporation, 80 pp.

Jirásek, J. A. (2006). *Zamyšlení na téma inovace*, [online] [cit. 2011-01-22]. Dostupné z: http://modernirizeni.ihned.cz/2-19494890-600000_d-1b.

Jones, O. (2003). Competitive Advantage in SMEs: Towards a Conceptual Framework. In: O. Jones and F. Tilley (Editors), *Competitive Advantage in SMEs: Organising for Innovation and Change*. Wiley, Chichester, pp. 15–33.

Kim, W., C., Mauborgne, R. (2005). *Blue Ocean Strategy: How to Create Uncontested Market Space and Make the Competition Irrelevant*. Boston: Harvard Business School Publishing, 240 pp.

OECD. (1997). *Oslo Manual: Proposed Guidelines for Collecting and Interpreting Technological Innovation Data*. 2nd Edition. Paris: OECD Publications, 122 pp.

OECD. (2005). *Oslo Manual: Guidelines for Collecting and Interpreting Innovation Data*. 3rd Edition. Paris: OECD Publications, 163 pp.

Penrose, E. (1959). *The Theory of Growth of the Firm*. New York: Oxford University Press, 296 pp.

Porter, M. (2003). *Competitive Advantage: Creating and Sustaining Superior Performance*. New York: The Free Press, 557 pp.

Schumpeter, J. (1950). *Capitalism, Socialism, and Democracy*. 3rd Edition. New York: Harper & Row Publishers, 448 pp.

Švejda, P. *et al.* (2007). *Inovační podnikání*. Praha: AIP ČR, 245 pp.

Tidd, J., Bessant, J., Pavitt, K. (2007). *Řízení inovací*. Brno: Computer Press, 549 pp.

Valenta, F. (1969). *Tvůrčí aktivita – inovace – efekty*. Praha: Svoboda, 258 pp.

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